Appendix I

Department of Ecology Fact Sheets

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Maury Island Gravel Mining Impact Studies

Project Startup Fact Sheet – October 1999

Public Workshops

In addition to the two Fact Sheets, information will be provided in two Public Workshops:

Tuesday October 26
Topic: Review of Work Plan for Maury Island Studies
7 to 9pm at Chautauqua Elementary School Multi-Purpose Room, 9309 SW Cemetery Road, Vashon, Washington.

June 2000
Topic: Results of Maury Island Studies
(Details to be provided at a later date).

Contact Information

Questions about the Maury Island Studies can be directed to:

Dave Garland
Water Quality Program
Ecology Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008
(425) 649-7031
dgar461@ecy.wa.gov

This Fact Sheet provides information about studies that the Washington State Department of Ecology (Ecology) has contracted to assess the environmental impacts of gravel mining on Maury Island. The first in a series of three Fact Sheets, it provides a brief overview of the project objectives and the work to be conducted to meet these objectives. Two other Fact Sheets will be issued:

- A *Mid-Study Fact Sheet*, based on interim findings, will discuss how future project tasks will be designed to address data needs.
- A *Project Completion Fact Sheet* will summarize the conclusions of the studies, including predicted impacts to the hydrogeology (groundwater and surface water) and nearshore environment

Background

Northwest Aggregates Company, a subsidiary of Lone Star Northwest, Inc., has applied to increase its rate of gravel extraction from an existing mine located on the eastern shore of Maury Island. This proposed action is currently in review under the State Environmental Policy Act (SEPA) process. A draft Environmental Impact Statement (DEIS) for the site was prepared for King County in July 1999 (Jones and Stokes, 1999). Earlier this year, the state legislature determined that independent studies of the mine's environmental impacts are needed. The legislature gave Ecology the responsibility to manage the studies, which will be conducted under contract with Pacific Groundwater Group of Seattle.

Areas for Investigation

Investigations will be conducted in the following four topic areas to fully assess the impacts of the proposed mining: groundwater, surface water, nearshore environment, and contaminated soils. Each topic is discussed below.

Publication Number 99-2039

Because the Maury Island studies are multidisciplinary in nature, they will be conducted by a team of consultants:

Pacific Groundwater Group: Groundwater and soil investigations, project management, and public involvement

Herrera Environmental Consultants: Surface water work and review of predesign engineering studies (stormwater detention/infiltration and soil containment cell)

EVS Consultants: Nearshore assessment work

***Attention Well Owners South of SW 240th Street**

If you live on Maury Island and own a water well, please consider being part of the well survey. The information you provide may be valuable for understanding groundwater flow patterns on the island. All you need to do is to fill out the form on the back of this Fact Sheet. Once we contact you, we'll ask for any information you can provide about the construction of your well. Depending on the depth and location of your well, we may come to your house to obtain a water-level measurement.

Groundwater

The groundwater systems that lie beneath the mine site are well understood because significant work has already been done. Previous investigators have described relationships between shallow aquifers underlying the study area. However, further investigations are needed to better understand how water in the *Principal Aquifer* is recharged, since recharge to this aquifer will probably change as a result of mining.

The current studies will address changes in recharge by characterizing groundwater flow patterns on site and off site. Some of the data required to do so is already available from previous studies; some will be obtained by drilling and installing five new wells—two on site and three off site—at strategic locations. Groundwater flow will also be assessed by measuring water levels in existing on-site and off-site wells. These wells will be located during an extensive field survey.*

Through these and other tasks, the conceptual model of groundwater flow at the site developed by previous investigators will be refined. It will be used to develop two computerized, mathematical models. The first of these, a spreadsheet-based model, will estimate the timing and magnitude of recharge under current and proposed mine conditions. The second will be a numerical groundwater flow model that will ultimately be used to predict and quantify impacts to the *Principal Aquifer* and local wells. After the numerical model has been "calibrated" to field conditions, it will be reviewed by an independent expert so that it is scientifically sound and technically unbiased.

Surface Water

The DEIS and supporting documents report that the site features no surface water but has several springs along its eastern bluff face. These conditions will be verified as part of the current studies. Although information about the location and flow rate of the springs exists, the water quality of the springs needs additional characterization. To meet this objective, water samples from the springs will be collected for analysis of dissolved solids, metals, nitrates, and other chemical constituents. Potential changes in spring flow rates resulting from mine expansion will be assessed using the numerical groundwater flow model.

These data can be used to help measure the impacts of mine expansion to on-site springs, an issue that was not specifically addressed in the DEIS or other site documents.

Nearshore Environment

Investigations for the nearshore environment in Puget Sound will focus on characterizing the habitats and species of fish, bottom-dwelling invertebrates, and marine mammals near the mine site. Critical resources that will be characterized in detail include:

- Fisheries habitat for commercially important species and for threatened or endangered species such as Puget Sound chinook salmon and Pacific herring
- Habitat for benthic, or bottom-dwelling, organisms
- Nearshore sediment quality

The project team plans to document features of the nearshore habitat such as sediment grain size, sediment surface features, and the location and lateral extent of eelgrass patches. Nearshore sediment samples will be collected to provide current information on sediment chemistry and analyzed for trace metals, organic carbon, total solids, hydrocarbons, PCBs, and chlorinated pesticides. This information will serve as a baseline against which future changes in sediment quality may be measured.

The project team will also identify the marine species of concern that are known or expected to use the project area and assess their sensitivities to potential impacts of the project. This information will provide a basis for evaluating potential impacts to communities or populations of these species.

Contaminated Soils

Soil contaminated with arsenic has been found on site. The source of this contamination is believed to be the ASARCO smelter in Tacoma. The nature and extent of this soil contamination has been characterized previously and will be further characterized in the next year. The data show contamination in the upper 18 inches of soil, which will be removed and contained on site under Lone Star's proposal for mine expansion. Sand and gravel from below the upper 18 inches will be mined and taken off site for its intended use under the current proposal. For these studies, the existing soil and soil leaching data will be summarized but no additional investigations are planned. The engineering integrity of the proposed contaminated soil containment system will be reviewed as part of the studies.

Potential Impacts on Nearshore Environment

In addition to characterizing current features of the nearshore environment, the Maury Island Studies will investigate:

- Noise from construction activities
- Turbidity
- Loss of habitat due to piling installation
- Spills or leaks of petroleum hydrocarbons
- Sediment disturbance from propeller wash
- Changes in habitat due to shading by barges
- Accidental spills of sand and gravel
- Piling installation effects on longshore sediment transport

Comment Form

Do you have comments about the information contained in this Fact Sheet? If so, write them on this form, tear it off, and send it to *Dave Garland* at the address shown below. Be sure to include a return address.

_____

_____

_____

_____

_____

_____

☐ Yes, I own a well and would like to be part of the well survey. You can contact me at the following address and telephone number:

Name _____

Address _____

Phone _____

Water Quality Program
Washington State Department of Ecology
Northwest Regional Office
3190 160th Ave SE
Bellevue, Washington 98008

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Maury Island Gravel Mining Impact Studies

Mid-Study Fact Sheet – January 2000

Background

Glacier Northwest (formerly Northwest Aggregates Company), a subsidiary of Lone Star Northwest, Inc., has applied to increase its rate of gravel extraction from a mine located on the eastern shore of Maury Island. This proposed action is currently in review under the State Environmental Policy Act (SEPA) process. The Department of Ecology has the responsibility to manage studies conducted by Pacific Groundwater Group and its subconsultants, Herrera Environmental Consultants and EVS Consultants. This Fact Sheet summarizes the interim findings of these studies. A *Project Completion Fact Sheet* will also be issued to summarize their conclusions.

Progress and Highlights of Mine Studies

Groundwater

- *Progress: 50 percent complete.* Completed tasks include monitoring well construction, water-level survey, groundwater flow analysis, and review of existing hydrogeologic data. The hydrogeologic impact analysis, which includes a recharge and a groundwater flow model, is in progress.
- *Highlights.* Groundwater in the Principal Aquifer flows toward the perimeter of the island. A groundwater divide lies in the center of the northwest part of the island.

Surface Water

- *Progress: 60 percent complete.* Completed tasks include field reconnaissance and collection of samples for water-quality analysis. The assessments of the stormwater infiltration/detention facility and of sediment runoff are in progress.
- *Highlights.* Samples of water from on-site springs met Washington State standards for Class AA (extraordinary) surface waters.

Nearshore Environment

- *Progress: 50 percent complete.* Completed tasks include the sea-floor survey, a side-scan survey, sediment profiling, and sediment sampling. The evaluation of project-related impacts to species of concern is in progress.
- *Highlights.* Nearshore sediments consist mostly of well sorted sands. Eelgrass beds were identified, along with other features that may provide marine habitats.

Contaminated Soils

- *Progress: 95 percent complete.* Completed tasks include the data review and assessment of the proposed soil-containment system.
- *Highlights.* The results of leachability testing reveal that arsenic in soil poses a minimal threat to groundwater. Some recommendations have been made for the proposed soil-containment system.

Publication Number 00-10-007

Summary of Interim Findings

Investigations are ongoing in the areas of groundwater, surface water, nearshore environment, and contaminated soils to assess the potential impacts of the proposed mining expansion. Work conducted to date and interim findings for each topic are summarized below. The final impact assessment will be completed by June 2000.

Groundwater

Five tasks were implemented to better characterize groundwater flow conditions at Maury Island:

- Literature Review
- Conceptual Model Assessment
- Aquifer Exploration and Analysis
- Well Inventory and Water Level Survey
- Hydrogeologic Impact Assessment

Literature Review

Seven reports on the hydrogeology of the mine site vicinity were reviewed to identify areas requiring further assessment. The results of this review were then summarized in a report entitled *Document Summaries and Areas of Further Investigation*, posted on Ecology's web site. This summary report was used along with the project work plan to design the groundwater impact studies.

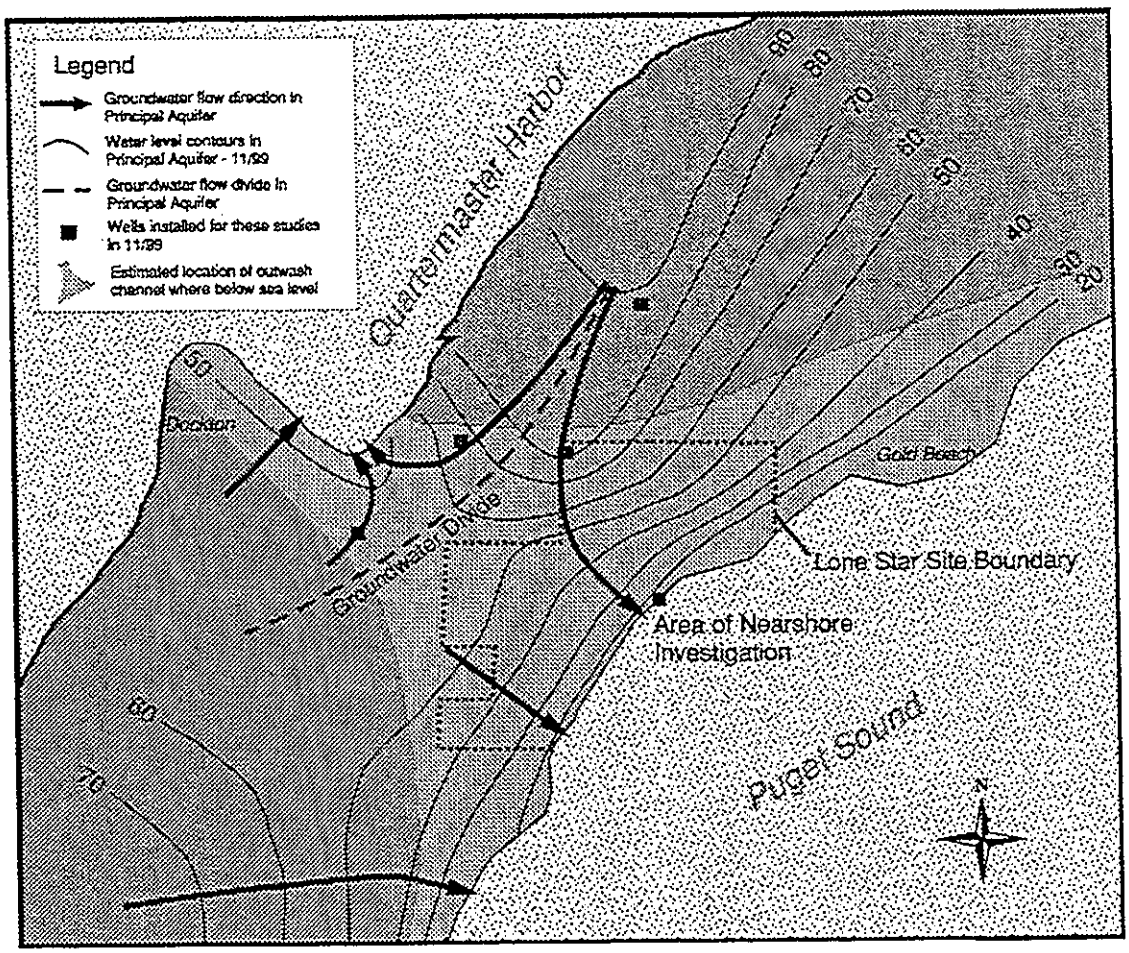
Visit Ecology's web site www.wa.gov/ecology for more information.

Conceptual Model Reassessment

Using both new and existing data, the conceptual understanding of groundwater flow on Maury Island was reassessed, yielding a better understanding of groundwater flow in the *Principal Aquifer*. This aquifer consists of "outwash"—sand derived from glacial melt waters about 14,000 years ago. It is the water-bearing portion of a subsurface channel that locally extends southeast from Dockton Park through the Lone Star site. The *Principal Aquifer* is underlain by finer-grained sediments that form a hydraulic boundary along the bottom of the aquifer, controlling groundwater flow. The flanks of this subsurface outwash channel are generally thinner and higher in elevation, causing groundwater flow into the center of the channel.

Aquifer Exploration and Analysis

A total of five new observation wells were installed in November 1999 to better characterize subsurface conditions and evaluate groundwater flow directions in the *Principal Aquifer*. Well depths ranged from 60 to 200 feet. Two new wells were completed on Lone Star property near existing wells. In general, the sediment types described by previous investigators correlate with materials observed at these wells. The three remaining wells were completed off site. These wells provide new information about the nature, extent, and thickness of the outwash sediments. They are also used for measuring water levels in the *Principal Aquifer*. Soil samples were collected from each well to identify any previously unidentified zones of saturation.



Groundwater Contours and Flow Direction in Principal Aquifer Near Lone Star Mine Site.

Well Inventory and Water-Level Survey

Water-supply wells and springs within a 4,000-foot radius of the Lone Star site were located in the field using records from Ecology, information from previous studies, and mail-in responses from the *Startup Fact Sheet*. After surveying the coordinates and elevations of the 47 accessible wells, water levels were measured. These data were used to estimate the direction of groundwater flow in the *Principal Aquifer* and to characterize the relationship between groundwater in the *Principal Aquifer* and in the *Sub Sea Level Aquifer*.

The survey results indicate that groundwater in the *Principal Aquifer* generally flows toward the perimeter of the island. A groundwater "divide" lies near the center of the aquifer; water flows southeast on one side of this divide and northwest on the other. Water levels are generally higher in

wells along the northwestern portion of Maury Island near Quartermaster Harbor and lower in wells at the Lone Star site. The survey results also suggest that the main source of recharge to Dockton Springs lies outside of the mine site.

Hydrogeologic Impact Assessment

The hydrogeologic impact assessment consists of two main analyses that are currently under development: a groundwater recharge analysis and a groundwater flow model. The recharge analysis will estimate recharge to the *Principal Aquifer* under current and proposed mining conditions using a model that estimates the rate and amount of downward water movement into soils, along with local land use, soil type, surficial geology, and precipitation data. It will also assess the timing of recharge. The groundwater flow model will simulate flow in the *Principal Aquifer* near the site under current and proposed mining conditions. This model is based on hydrogeologic data collected during recent and previous investigations. Both assessments use the conceptual hydrogeologic model as the basis for quantifying groundwater flow.

Surface Water

Three tasks were implemented to better understand surface water near the Maury Island mine site:

- On-Site Spring Assessment
- Stormwater Infiltration/Detention Facility Evaluation
- Sediment Runoff Assessment

On-Site Spring Assessment

Two site visits were made to assess the flow and quality of springs in the mine area under both dry-weather and early wet-weather conditions. Samples were collected and analyzed for temperature, pH, conductivity, total dissolved solids, nitrate, nitrite, arsenic, cadmium, and lead. No metals were detected in any sample. All samples met Washington State water-quality standards for Class AA (extraordinary) surface waters. They also met State drinking water standards.

Because the quality of the springs is good, it appears that contaminants have not leached from the mine area under current conditions. Since contaminated soils will be transported and stored in containment facilities, the possibility of leaching will be further reduced, although contaminants could be mobilized if it rains during excavation and transport.

Stormwater Infiltration/Detention Facility Evaluation

Since no specific designs have been proposed for a stormwater infiltration/detention facility at the mine site, a detailed evaluation could not be performed. A preliminary review, however, indicates that the "sole source" designation of the aquifer underlying the site poses special concerns for the design of this facility. One concern is that the infiltration rate must be less than 2.4 inches per hour, unless the soil beneath the facility has certain physical and chemical properties that enable effective treatment with faster infiltration rates. Another concern is the potential for clogging by fine-grained materials, which

could result in overflows of untreated water to Puget Sound.

Sediment Runoff Assessment

The results of a site visit indicate that very little surface runoff currently occurs at the mine site, that runoff does not currently flow to a designated stormwater control area, and that there are no areas with significant accumulations of sediment. Consequently, stormwater and related sediment samples could not be collected as originally planned for this assessment. The lack of sediment is due to the granular nature of the geologic materials present on site, materials that promote infiltration and do not provide a significant source of mobile, fine-grained sediment. This finding is supported by the results of grain-size analyses for samples collected during the drilling of on-site monitoring wells.

The effects of sediment runoff are being evaluated using a different approach, which involves reviewing leaching data for metals in soil in the most contaminated parts of the site. It also involves reviewing available groundwater and surface-water quality results, which indicate that little leaching has occurred under current conditions. The potential for finer-grained soils to erode and enter runoff on the mine site will be assessed qualitatively. Results of this investigation will be summarized in the final report.

Nearshore Environment

Two tasks were implemented to better understand the nearshore environment of Maury Island:

- Literature Survey
- Baseline Characterization

Literature Survey

The literature was surveyed to identify resources and similar studies documenting the effects of project-related impacts to the nearshore resources and species of concern. The findings of this survey are reported in a technical memorandum entitled *Literature Review for Nearshore Assessment*. The document discusses potential uses of the nearshore area by the Puget Sound chinook salmon and the Pacific herring. It also discusses potential impacts of the project construction and presents a list of published scientific studies that will provide the basis for the nearshore assessment.

Baseline Characterization of Nearshore Habitat

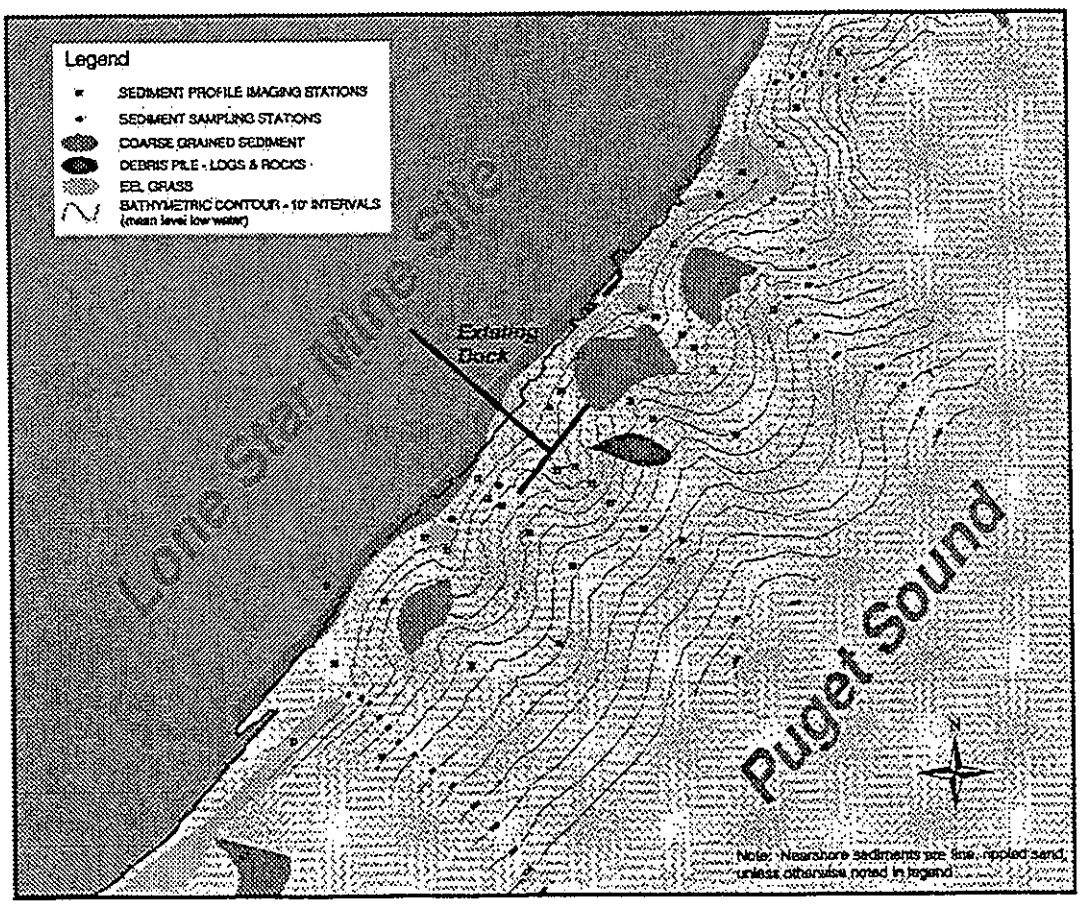
A series of field investigations was completed to document approximately 3,000 feet of Maury Island coastline, centering on the Lone Star dock. The investigations comprise the most comprehensive characterization of nearshore sediment conditions to date and included:

- A survey to characterize the topography of the seafloor

- A high-frequency, side-scan sonar survey to document sediment type and seafloor features such as eelgrass beds
- Sediment profile images from 39 locations at depths ranging from 5 to 105 feet to document physical and biological seafloor properties
- Sediment grab samples from six locations immediately inshore and offshore of the dock facility to document baseline sediment chemistry

The results of the field investigations indicate that the nearshore is characterized by a series of submerged beach cusps with alternating hills and valleys that run perpendicular to the shoreline. The hill crests lie approximately 300 feet apart. The Lone Star dock is located on one of these crests.

The surface sediments primarily consist of fine to medium, well-sorted sands, although several patches of small rocks and cobble of both natural and anthropogenic origin were



Nearshore Features at the Lone Star Site, Maury Island.

observed. No evidence of fine-grained muds or organic loading was found in any of the areas surveyed.

Eelgrass beds are confined to areas of the nearshore that are less than 20 feet deep. Some relatively small eelgrass patches lie near the dock, an extensive bed runs along the shore 500 feet to the southwest of the dock, and another large bed runs 400 feet to the northwest. Two sunken barges and a small vessel were identified southwest of the dock. A debris pile of logs and rocks was identified just off the northwest face of the dock, along with a few isolated sunken logs.

Contaminated Soils

Two tasks were implemented to assess contaminated soils at the Lone Star site:

- Data Summary and Review
- Soil Containment System Assessment

Data Summary and Review

The nature and extent of soil contamination at the Lone Star site were assessed using soil chemistry and leaching data presented in the DEIS and other documents. The data were reviewed and summarized in a technical memorandum.

Arsenic concentrations are highest in surface soils but decrease with depth. The highest concentrations are found in the western portion of the Lone Star site, where they exceed 200 parts per million (ppm). The maximum measured arsenic concentration is 477 ppm. These values are greater than the Washington State cleanup levels for both industrial and residential sites. Arsenic concentrations in deeper soils (from the mined portion of the site) are generally below the residential cleanup level of 20 ppm; in other areas, they are below this cleanup level in samples collected from a depth of 24 inches. Lone Star plans to remove all soil that is contaminated above residential cleanup levels and construct a containment cell to store it on site.

Laboratory leachability tests indicate that arsenic and other metals in the most contaminated surface soils are relatively immobile. Consequently, the metals are not expected to present a risk to groundwater when disturbed during mine expansion. This laboratory finding is supported by field observations—the background concentrations of metals in groundwater at the mine site meet State drinking water standards. Since the metals in these soils are mostly non-leachable, they pose a minimal threat to long-term groundwater quality.

Soil Containment System Assessment

The design of the proposed containment system for contaminated soils was evaluated, along with the potential environmental impacts of the system. The results of this evaluation are summarized in a technical memorandum that identifies contaminant pathways and impacts in case of a containment system failure. The following measures are strongly recommended if the soil-containment system is permitted.

- A "linear low-density polyethylene" geomembrane should be used to line and cover the cell instead of bentonite clay. This will minimize potential leakage and improve constructability.
- Additional sand should be used in the cell liner and cover system to preserve impermeable materials during construction.
- A berm should be constructed at the toe of the cell. It should have a minimum of 3 feet of freeboard in case the leachate collection system becomes clogged or plugged.
- The slope angles and drainage properties of the cover system should be carefully reevaluated to ensure that it does not fail, causing off-site erosion.
- The site grading plan should be revised to eliminate the direct-runoff pathway to Puget Sound at the cell's east end.

Preliminary seismic modeling predicts that materials in the cell would be stable against catastrophic gravity-driven sliding under static and post-earthquake conditions.

Public Workshops

The final study results will be discussed at a Public Workshop in June 2000. Details will be provided at a later date.

Project Contact

Dave Garland can be contacted at the address shown below, at *dga461@ecy.wa.gov* or at (425) 649-7031.

If you need this information in an alternative format, please call Dave Garland at (425) 649-7031 (Voice) or (425)649-4259 (TDD).

Water Quality Program
Washington State Department of Ecology
Northwest Regional Office
3190 160th Ave SE
Bellevue, Washington 98008

WASHINGTON STATE DEPARTMENT OF ECOLOGY

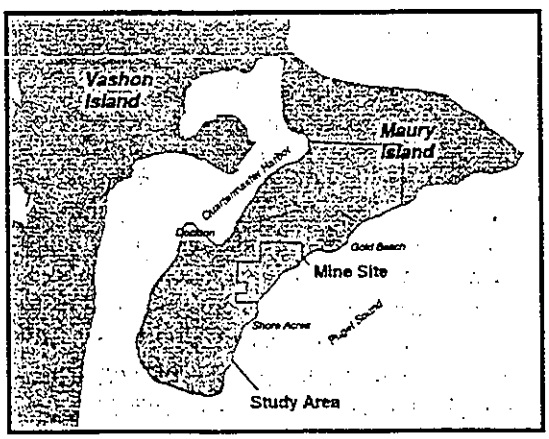
Maury Island Gravel Mining Impact Studies

Final Fact Sheet – June 2000

Background

Glacier Northwest (formerly Northwest Aggregates Company), a subsidiary of Lone Star Northwest, Inc., has applied to increase its rate of gravel extraction from 10,000 tons per year to as much as 7.5 million tons per year. The mine is located on the eastern shore of Maury Island. This proposed action is currently in review under the State Environmental Policy Act (SEPA) process. The Washington Department of Ecology has the responsibility to manage studies conducted by Pacific Groundwater Group and its subconsultants, Herrera Environmental Consultants and EVS Consultants. This Fact Sheet, the final in a series of three, summarizes the findings of these studies and presents the predicted impacts to groundwater, water quality, the nearshore environment, and soils.

Study Area for Maury Island Impact Studies



Summary of Impacts

Groundwater

Impacts to Maury Island's groundwater system are predicted to be limited primarily to the mine site and its immediate vicinity. The timing, rate, and possibly the distribution of recharge to the *Principal Aquifer* will change as a result of the proposed mining. An overall long-term decrease in recharge and a corresponding decline in groundwater levels is predicted. However, this decrease will not be significant, nor will it adversely affect nearby water-supply wells. Spring flows near Dockton Park are expected to decrease slightly, although impacts to springs located below the mine site will be greater.

Water Quality

Concentrations of arsenic and other metals are not expected to increase substantially in springs and surface water as a result of mining activities, although contaminants could be mobilized in the mine area if it rains during soil excavation and transport.

Nearshore Environment

Impacts to the nearshore environment may occur depending on the timing of the mining operations. Spawning herring may be affected by noise during pier reconstruction and barge operations. The nearshore vegetation and the benthic community could also be impacted if a large gravel spill occurs.

(Continued on next page.)

Publication Number 00-09-005

Soils

Metals and arsenic in soils are not expected to threaten groundwater when contaminated sediments are disturbed and contained during mine expansion.

Discussion of Impacts

Groundwater

Aquifers are recharged as precipitation infiltrates from the ground surface and moves downward to the water table. Changes in the rate and timing of recharge to the *Principal Aquifer* were assessed because of their potential effect on the availability of groundwater. These changes were assessed using two mathematical models. The first model simulated recharge processes at the land surface. The second simulated the vertical movement of recharge between the root zone and the water table. Water-level data were also analyzed to estimate the lag time between seasonal recharge events and responses in the *Principal Aquifer*. The conceptual hydrogeologic model for the Maury Island study area was revised based on field data and used as a framework for the mathematical models.

The results of the recharge analysis indicate that recharge *in the mine area* will be impacted as follows if up to 350 feet of gravel and sand are removed as proposed:

- Recharge to the *Principal Aquifer* will increase in the wet season and decrease in the dry season.
- Annual recharge to the *Principal Aquifer* will decrease slightly because the vegetative cover will be modified during mine excavation and reclamation.
- The movement of recharge water may change in the *Principal Aquifer*.
- Recharge to the deep aquifer will decrease slightly.

A third mathematical model was developed to estimate impacts to the *Principal Aquifer* based on the revised conceptual model and the results of the recharge models. This groundwater flow model featured three layers representing the *Principal Aquifer*, an aquitard, and the deep aquifer. It also incorporated hydraulic boundaries along the coast and at near-site springs. To verify its accuracy, the model was calibrated using water levels measured in the field. It was then run for the preferred mine-expansion alternative, simulating conditions during the three phases of mine excavation and site reclamation. The model was reviewed by an independent expert to help ensure its suitability for predicting impacts.

The model predicts that because of the changes to recharge in the mine area, small impacts to the *Principal Aquifer* and to springs will occur in parts of the study area. The impacts discussed below are conservative estimates, reflecting worst-case conditions.

- Water levels are predicted to decline over the long term by less than 1 foot at the mine site and less than 0.5 immediately adjacent to the site. These impacts, which are small compared to natural water-level fluctuations, should not adversely affect nearby water-supply wells.
- Regional groundwater flow directions are not expected to change appreciably.
- Average annual flows in springs near Dockton Park are expected to decrease slightly—by up to 0.5 gpm—by the end of reclamation. Seasonal flow variations at these springs are expected to increase by less than 2 percent of their current flow. Impacts to flows from Spring E, located along the beach face below the mine site, will be greater.

Water Quality

Concentrations of arsenic and other metals are not expected to increase substantially in springs and groundwater as a result of mining activities via soil leaching, surface water runoff, or stormwater infiltration. Since contaminated soils will be transported and stored in a lined containment cell, the possibility of leaching will be further reduced. However, contaminants could be mobilized if it rains during excavation or transport of soil to the containment cell and appropriate mitigation measures are not taken. Contaminants could also be mobilized if the containment system fails.

Nearshore Environment

Some impacts to the nearshore environment are expected to occur because of mine expansion, as presented in the table below. The most notable impacts will be to herring, which will be affected by noise during pier reconstruction and barge operations, particularly during their pre- and post-spawning stages when they are most sensitive. The degree of the impacts will depend on several factors:

- The location of the spawning grounds
- The timing of pier reconstruction
- The travel route and destination of barges

If the pier is not reconstructed during the spawning season (January through April), impacts due to pier reconstruction are expected to be negligible. Impacts to spawning herring due to barge operations could range from negligible to substantial.

Other impacts could occur to the vegetation and benthic community because of barge operations. A large gravel spill could smother the benthos and vegetation, particularly eelgrass, although the benthic community would recolonize. In addition, the shading of lighted nearshore areas is expected to moderately impact eelgrass and macroalgae within the barge loading areas.

Potential Impacts to Aquatic Resources

	Benthic Community		Vegetation		Salmonids (threatened/ endangered)		Herring (candidate species)		Rockfish (candidate species)		Cod-like Fish (candidate species)		Other Fish Species		Marine Mammals	
Activity/Stressor	Info	Impact	Info	Impact	Info	Impact	Info	Impact	Info	Impact	Info	Impact	Info	Impact	Info	Impact
Pier Reconstruction																
Noise	–	–	–	–	●	△	●	△–▲	●	△	●	△	○	△	●	△
Turbidity	●	△	◉	△	●	△	●	△	●	△	●	△	●	△	●	△
Habitat Loss	●	△	●	△	●	△	●	△	●	△	●	△	●	△	●	△
Barge Operations																
Noise	–	–	–	–	●	△	●	△–▲	●	△	●	△	●	△	●	△
Chemicals-chronic	●	△	–	–	●	△	●	△	●	△	●	△	●	△	●	△
Propeller wash	●	△	○	△	●	△	●	△	●	△	●	△	●	△	●	△
Light shading	–	–	●	▲	○	△	○	△	○	△	○	△	○	△	○	△
Gravel spills	●	▲	●	▲	●	△	●	△	●	△	●	△	●	△	●	△
Night lighting	–	–	–	–	○	△	○	△	○	△	○	△	○	△	–	–

Information available to support decision:

- ○ limited information
- ◉ moderate information
- ● sufficient information

Estimated population impact:

- △ negligible impact (no long-term measurable changes in viability of population)
- ▲ moderate impact (measurable changes to abundance or distribution of aquatic resource)
- ▲ substantial impact (measurable changes that could threaten the viability of the aquatic resource)
- – out of scope

Contaminated Soils Containment

Concentrations of metals such as arsenic in soils vary throughout the study area and are highest at the mine site. Based on the results of leachability tests and other water-quality analyses, metals are not expected to present a risk to groundwater when contaminated soils are disturbed during mine expansion.

The most likely mechanism for releasing soil contaminants would be a failure of the cell cover system. Design improvements are recommended to reduce the risk of cell failure.

If you need this information in an alternative format, please call Dave Garland at (425) 649-7031 (Voice) or (425) 649-4259 (TDD)

Final Public Meeting

A Final Public Meeting will be held to discuss the results of the Maury Island Studies.

When: Thursday June 22, from 7:00 to 9:15 p.m.

Where: Multi-purpose room of McMurray Middle School, 9329 SW Cemetery Road, Vashon, Washington, 98070.

Project Contact

Questions about this Fact Sheet or the Maury Island Studies may be directed to Dave Garland, Water Quality Program, Washington State Department of Ecology, Northwest Regional Office, 3190 160th Ave SE, Bellevue, Washington, 98008; telephone: (425) 649-7031; email: *dgar461@ecy.wa.gov*

Water Quality Program
Washington State Department of Ecology
Northwest Regional Office
3190 160th Ave SE
Bellevue, Washington 98008